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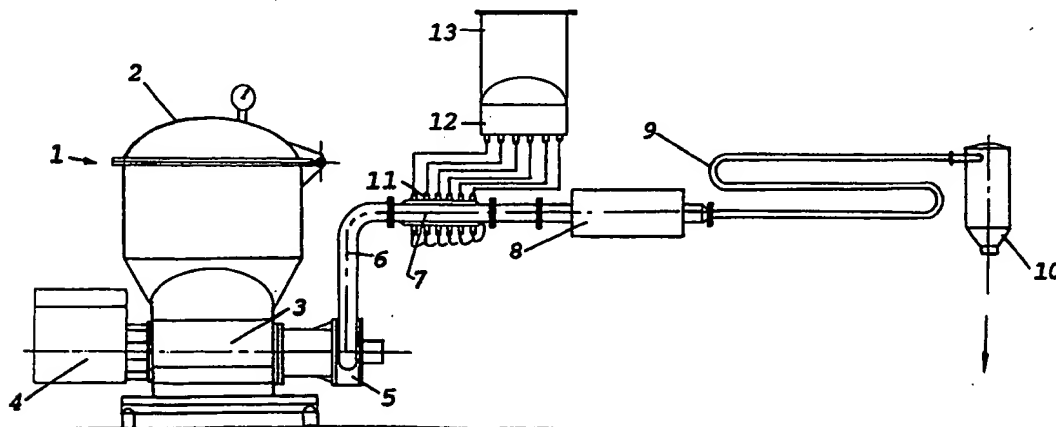
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(54) **Method and apparatus for injecting a liquid in the form of thin penetrating jets into meat.**

(57) Instead of using injection needles, that have to be inserted into and withdrawn from the meat with the latter substantially stationary relative to the needles, the method and apparatus of the invention use high-pressure nozzles (11) directing powerful jets of liquid (not shown) penetrating into the meat (not shown) to the requisite depth, preferably while the meat is being conveyed through a set of conduits, including a unit (7) containing said nozzles (11),

preferably also a vibration-massage unit (8) and a deformation-massage unit (9), before being delivered through an outlet unit (10).

With this arrangement, the disadvantages of using needles, such as risk of breakage, difficult cleaning and disinfection, are avoided, at the same time achieving the advantage of allowing the meat to pass continuously - such as conveyed by means of a pump (5) - through the injection region.



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## TECHNICAL FIELD

The present invention relates to a method of treating meat or similar organic material, said method being of the kind set forth in the preamble of claim 1.

## BACKGROUND ART

In methods of this kind, it is known to inject brine or other liquid into meat by using injection needles, which have to be inserted into the meat before injecting the liquid, and then removed again. The use of needles for this purpose is associated with many disadvantages, of which but a few may be mentioned, such as

- that the injection needles are costly,
- that the injection needles are easily broken if they are thin, and rupture or cut the meat fibres if they are thick,
- that the injection needles are difficult to clean and disinfect to the high standard required in food-processing apparatus,
- that the spacing of the injection points is set, usually permanently, by the spacing of the injection needles, and
- that no relative movement between the injection needles and the meat transverse to the longitudinal direction of the needles is possible, making it impossible to pass the meat at a constant speed through an injection unit.

## DISCLOSURE OF THE INVENTION

It is the object of the present invention to provide a method of the kind initially referred to, that does not suffer from the disadvantages mentioned above, and this object is achieved with a method of the kind referred to above, which according to the present invention is characterized by the feature set forth in the characterising clause of claim 1. With this arrangement, the injection is achieved without the use of injection needles, so that the above-mentioned disadvantages resulting from the use of such needles are totally eliminated.

The present invention also relates to an apparatus for carrying out the method of the invention. This apparatus is of the kind set forth in the preamble of claim 7, and is according to the present invention characterized by the features set forth in the characterising clause of this claim 7.

Advantageous embodiments of the method and the apparatus, the effects of which - in so far as they are not obvious - are explained in the following detailed portion of the present specification, are set forth in claims 2-6 and 8-14 respectively. Already at this point it should, however, be mentioned that the embodiments of the method and the

apparatus set forth in claims 5 and 13 respectively makes it possible to vary the spacing of the injection points by simply varying the intervals between the "shots" and/or the speed, with which the meat is moved past the injection nozzles.

## BRIEF DESCRIPTION OF THE DRAWING

In the following detailed specification, the present invention will be explained in more detail with reference to the drawing, the single Figure of which in a highly simplified manner shows an exemplary embodiment of an apparatus for carrying out the method of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The exemplary embodiment of an apparatus according to the present invention shown on the drawing is adapted to receive, process and deliver meat in a number of stages arranged in sequence, i.e.

- a vacuum hopper 1 with a cover 2, that may be opened to allow meat (not shown) to be placed inside the vacuum hopper 1,
- a screw conveyor 3 driven by a motor 4 and adapted to convey meat from the vacuum hopper 1 to a rotary displacement pump 5, e.g. of the kind disclosed in European Patent No. 0.187.357, delivering meat through
- a pipe 6 to
- a brine injection unit 7, from which the meat, due to the pressure exerted by the pump 5, moves further into
- a vibrational massage unit 8, from which the meat continues into
- a deformation-massage unit 9, from which the meat continues into
- an outlet unit 10, which may be adapted to deliver the processed meat into a suitable container or bag or to means for conveying the meat to e.g. a packaging machine, or else for further processing.

The brine injection unit 7 contains a number of nozzles 11 adapted to direct powerful jets of brine supplied to the nozzles at high pressure by a pump unit 12, the latter being supplied with brine from a brine tank 13. The pump unit 12 may be equipped with a single pump supplying all the nozzles 11, or a number of pumps, e.g. one for each nozzle or pair of set of nozzles. These pumps may be adapted to deliver the brine continuously or - preferably - intermittently, such as in short bursts separated by comparatively longer intervals.

When the apparatus shown in the drawing is to be put into operation, the vacuum hopper 1 is opened by opening the cover 2, after which a

suitable amount of meat to be processed is placed in the hopper 1, and the cover 2 closed. Then, the hopper 1 is evacuated in the normal manner so as to remove air from the hopper itself and from spaces in and between the pieces of meat. Alternatively, the hopper may have a constant vacuum and be fed through a pump or a suitable vacuum trap in order to maintain a continuous operation.

When the vacuum has reached the desired value, the motor 4 is started, and with it the screw conveyor 3 and the rotary displacement pump 5, so that the meat will literally be pumped through the pipe 6, the brine injection unit 7, the vibrational massage unit 8, the deformation-massage unit 9 and the outlet unit 10 to the receiving means connected to the latter.

During the movement through the brine injection unit 7, the meat is subjected to injection of brine by the brine jets from the nozzles 11 impinging upon it and - due to the high pressure of the liquid supplied by the pump unit 12 - penetrating into the meat to a depth depending on the pressure and the physical characteristics of the meat.

As the brine injection unit 7 as well as the vibrational massage unit 8 immediately downstream of it are in the form of a substantially closed conduit - in the example shown roughly in the form of a simple shaped pipe - the brine having been injected will not flow out from the meat, and in the vibrational massage unit 8 it will be distributed among the fibres of the meat, thus achieving the desired "pickling" effect.

As the meat has been transported from the vacuum hopper 1 to the brine injection unit 7 through closed conduits, the vacuum state - at least as far as included air and gases is concerned - is still present when the meat arrives into the brine injection unit 7, so that the injection will in fact take place under vacuum conditions, provided, of course, that there is a sufficient quantity of meat in the units 8, 9 and/or 10 to prevent air from entering the injection unit 7.

If the brine jets are ejected by the nozzles 11 in a continuous manner, there is a possibility that the jets may cut longitudinal slits in the meat passing through the injection unit 7, and to avoid this slit formation, the pump unit 12 may be adapted as indicated above to deliver the brine in short bursts separated by comparatively long intervals. With this arrangement, the meat passing through the brine injection unit 7 will be subjected to a number of "shots" of brine in discrete regions, from which it will flow in between the fibres when subjected to vibration in the vibrational massage unit 8. The spacing of these discrete regions will, of course, depend on the time intervals between the "shots" and on the speed, with which the meat the meat moves through the injection unit 7, and

this spacing may be adjusted to suit the particular type of meat being processed by varying either or both of these parameters. Also, the injection pressure and the duration of each "shot" may be varied to suit the particular type of meat.

In the example shown, the brine injection unit 7 and the vibrational massage unit 8 are shown as two distinct separate units, but it lies within the scope of the present invention to have these two units partly or fully integrated with each other, so that the meat may be subjected to vibrational treatment while still being injected with brine.

In the exemplary embodiment shown, there is only a single vacuum hopper 1 with associated screw conveyor 3, thus making it necessary to stop the apparatus, when a new batch of meat is to be introduced. This disadvantage may, however, be easily overcome by using two vacuum hoppers in parallel, adapted to be connected alternately to the remainder of the apparatus shown, or as previously mentioned by introducing the meat through a pump or vacuum trap.

The vibrational massage unit 8 may be equipped with vibrators of any suitable kind, such as producing infrasonic, sonic or ultrasonic vibrations of suitable frequency and amplitude, in order to achieve the requisite distribution of the injected brine between the meat fibres without causing damage to the latter. At present, ultrasonic vibrations are preferred, as they appear to be more effective in distributing the injected brine than sonic or infrasonic vibrations.

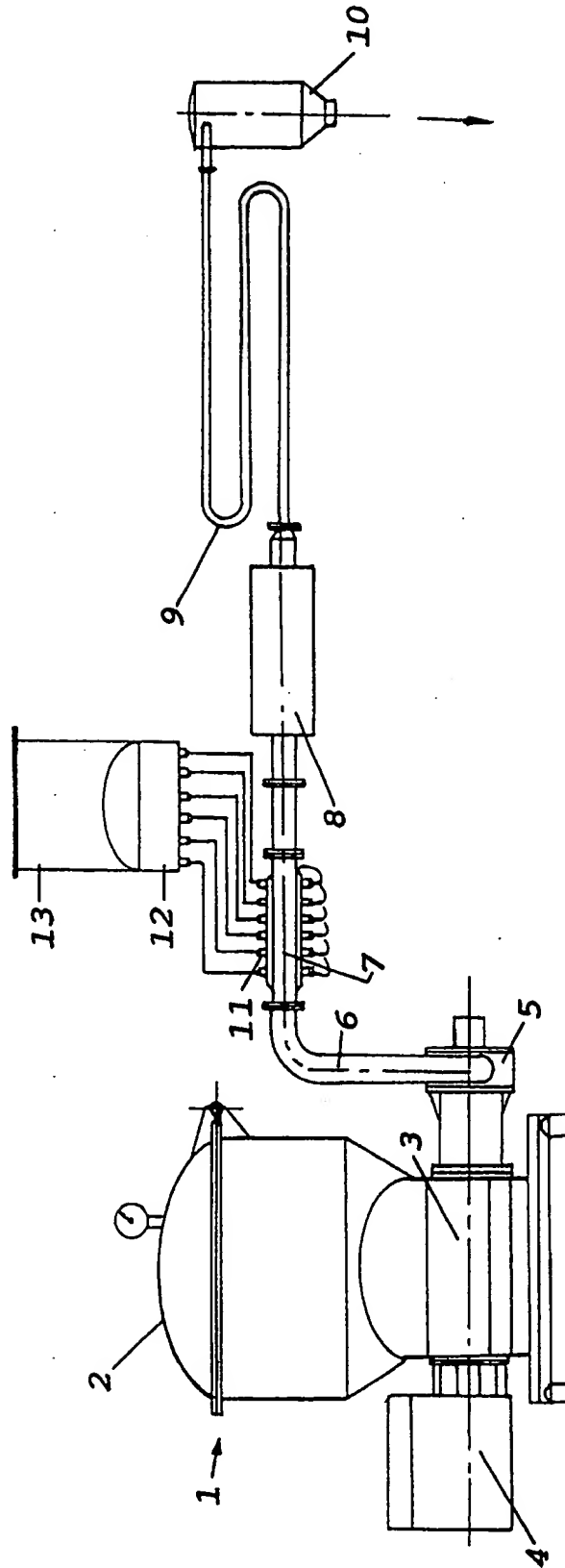
The deformation-massage unit 9, which is optional, consists of a simple tube with a substantially smaller internal diameter than the tubular parts of the brine injection units 7 and the vibrational massage unit 8. The reduction in diameter at the entrance to the deformation-massage unit 9 forces the pieces or chunks of meat to change shape, thus undergoing a kind of "deep massage", and during the passage through the massage unit 9 itself, the meat will be massaged by contact with the inside of the tube constituting this unit. An additional massage effect could be achieved by means of a spatial variation of the diameter of this tube.

In the above description, the present invention is explained with reference to treating meat with brine, i.e. a solution of common salt, possibly with certain additives. It does, however, lie within the scope of the present invention to inject other liquids into both meat, meat products and similar organic materials or products of same.

## Claims

1. A method of treating meat or similar organic material, comprising injecting a liquid into the

- meat, **characterized** in that the liquid is injected in the form of thin jets capable of penetrating the meat to the requisite depth.
2. A method according to claim 1, **characterized** in that the meat is subjected to vibrations during and/or after the injection of the liquid. 5
  3. A method according to claim 1 or 2, **characterized** in that the meat is conveyed through conduits substantially closed to the environment during said treatment. 10
  4. A method according to claim 3, **characterized** in that the liquid is injected into the meat at a location in said conduits, in which these are shaped substantially like a closed pipe causing the meat to have a well-defined shape and flow. 15
  5. A method according to any one or any of the claims 1-4, **characterized** in that the jets of liquid are applied intermittently or periodically, preferably in short bursts separated by comparatively long intervals. 20
  6. A method according to any one or any of the claims 1-5, **characterized** in that after having been vacuum-treated to remove included air, the meat is introduced into said conduits in such a manner, that the evacuated state is maintained, at least until the injection with liquid has taken place. 25
  7. An apparatus for carrying out the method according to any one or any of the claims 1-6 and of the kind comprising 30
    - a) means (7) for holding meat in a manner allowing it to receive liquid injected into it by
    - b) injections means (11),**characterized in**
    - c) that said injection means is/are constituted by at least one injection nozzle (11) with associated liquid supply means (12, 13) capable of supplying liquid at a pressure sufficient to cause the ensuing jet(s) of liquid issuing from the nozzle(s) to penetrate into the meat to a depth requisite for the treatment being carried out. 35
  8. An apparatus according to claim 7, **characterized** by means (8) for subjecting the meat to vibrations during or after the injection of liquid by said injection means (11, 12, 13). 40
  9. An apparatus according to claim 7 or 8, **characterized** by
    - a) conduits (6, 7, 8, 9) substantially closed to the environment, said injection nozzle(s) (11) being adapted to direct said liquid jet(s) into the interior of said conduits so as to impinge on and penetrate into meat passing therethrough,
    - b) vibrating means (8) cooperating with or constituting part of said conduits and situated on the same location as said nozzles (11) and/or downstream of same, and
    - c) conveying means (3, 5) for making the meat move through said conduits from inlet means (1, 2) to outlet means (10) upstream and downstream respectively of said nozzles and said vibrating means. 45
  10. An apparatus according to claim 9, **characterized** by deformation massage means (9) constituting part of said conduits (6, 7, 8, 9) and situated upstream of said outlet means (10). 50
  11. An apparatus according to any one or any of the claims 7-10, **characterized** in that said conveying means (3, 5) comprise(s) at least one displacement pump (5), preferably of the rotary type, situated upstream of said injection nozzles (11). 55
  12. An apparatus according to any one or any of the claims 7-11, **characterized** by a vacuum-treatment chamber (1) situated upstream of said conveying means (3, 5) and connected to or constituting at least part of said inlet means (1, 2).
  13. An apparatus according to any one or any of the claims 7-12, **characterized** in that said nozzle(s) (11) and/or said liquid-supply means (12, 13) is/are adapted to produce said jets of liquid intermittently or periodically, preferably in short bursts separated by comparatively long intervals.
  14. An apparatus according to any one or any of the claims 7-13, **characterized** in that said conduits (6, 7, 8, 9) are substantially tubular with a substantially constant internal diameter throughout their length, with the exception of said deformation-massage means (9), the latter having a substantially smaller internal diameter, possibly varying along the length of said means (9).





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## EUROPEAN SEARCH REPORT

Application Number

EP 91 10 9159

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 769 037 (J.J. SHOLL) - - -		A 23 B 4/28
A	US-A-3 814 007 (D.H. LUMBY et al.) - - -		
X	US-A-3 675 567 (J.J. REJSA et al.) * The whole document *	1,3,7	
X	US-A-3 436 230 (C.M. HARPER et al.) * The whole document *	1,3,7	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 23 B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 26 August 91	Examiner GUYON R.H.
<div>CATEGORY OF CITED DOCUMENTS</div> <div>X: particularly relevant if taken alone</div> <div>Y: particularly relevant if combined with another document of the same category</div> <div>A: technological background</div> <div>O: non-written disclosure</div> <div>P: intermediate document</div> <div>T: theory or principle underlying the invention</div> <div>E: earlier patent document, but published on, or after the filing date</div> <div>D: document cited in the application</div> <div>L: document cited for other reasons</div> <div>&amp;: member of the same patent family, corresponding document</div>			